Patent Application of:

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for

TITLE OF THE INVENTION: A FASTENER

CROSS-REFERENCE TO RELATED APPLICATIONS:

The entire disclosure of United Kingdom patent application number 0307401.0 filed on March 31, 2003 is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION:

1. FIELD OF THE INVENTION:

The present invention relates to fasteners, and in particular to a fastener for closing an airbag cover.

2. DESCRIPTION OF THE RELATED ART:

Cars are often provided with airbags, for use as a safety device in case of a collision. An airbag is provided at the front of the car, e.g. on the central part of the steering wheel. If a collision occurs, a sensor detects the collision, and the airbag is immediately inflated. This will cushion a person who is thrown forwards from the car seat.

It is becoming more common for cars to be provided with side airbags as well as front airbags, to give increased protection in the event of a side-on collision. The side airbags inflate into a space between the car seat and the door of the car, cushioning an occupant of the seat against an impact with the side of the car. A common place to install side airbags is inside the back of the car seat. When a collision occurs, the airbag inflates, and pushes through an opening, such as a slit, in the side of the car seat. The emerging airbag expands along the side of the car, to protect the driver from hitting the car door.

The opening on the car seat, through which the airbag emerges, should be kept closed in normal use, but should open as the airbag inflates. It is known to keep the airbag opening closed by having it sewn up with yarn. When the airbag inflates, the pressure against the yarn causes the yarn to break, allowing the airbag to emerge from the car seat, and protect an occupant of the car.

However, it is not a straightforward process to sew up the airbag opening. The opening must be sewn to controlled criteria, such as yarn type, number and type of stitches, tension, etc. to ensure the yarn breaks when the airbag inflates, but also to ensure the yarn does not break during normal use of the vehicle.

It is sometimes necessary to gain access to an airbag for routine checking or maintenance, in which case the yarn must be removed and the opening re-sewn to the required criteria after the maintenance is completed.

We aim to provide a closure for an airbag opening which overcomes some of the problems mentioned above. In particular, we provide a closure for an airbag opening which closure comprises a zip fastener and means for facilitating opening of the fastener when a force is applied transverse to the plane of the fastener.

Further objects and advantages of the invention will become apparent from a consideration of the drawings and ensuing description.

SUMMARY:

A zip fastener provides a mechanism for easily closing an opening. It is known that zip fasteners can be opened (or broken) at a point along the row of coupling elements if sufficient force is applied to the fastener to separate the coupling elements of the fastener. It is difficult to provide a fastener in which the coupling elements will reliably disengage in this way when a predetermined force is applied. However, the engaging coupling elements can be readily peeled apart once a break is made, or from an end of

the row of elements if, for example, the slider inadvertently moves past the upper end stops.

Thus, in a first aspect of the invention, we provide a zip fastener having a pair of tapes which are joined by rows of coupling elements mounted on the respective tapes, wherein a point of weakness is provided at a predetermined position along the fastener so that the coupling elements will separate at the point of weakness when a predetermined force is applied to the fastener. More than one point of weakness may be provided along the fastener.

The point of weakness may be a gap in at least one of the rows of elements. Preferably, a frangible connection or a releasable connection is provided at the point of weakness in order to retain the adjacent elements in engagement until the connection is broken or released.

In another embodiment, a slider provides the point of weakness. Pressure transverse to the plane of the fastener at the slider will cause the tapes to bulge outwards and urge the slider back along the row of elements, opening the zip fastener. Two sliders can be provided, the sliders closing the fastener from opposite directions, and meeting at an intermediate position to close the fastener. The sliders may be coupled together by a frangible or releasable connection.

Preferably, the or a point of weakness is provided in a central region, when measured from the ends of the opening provided by the opened fastener. Preferably a point of weakness is provided in a central half of the fastener, in a region between one quarter and three quarters of the length of the fastener. More preferably, a point of weakness is provided substantially mid-way along the fastener, i.e. at half the length of the fastener.

Another aspect of the present invention provides a fastener comprising first and second stringer tapes, each with a row of coupling elements mounted thereon, such that when the fastener is closed, said stringer tapes are connected to each other by means of said coupling elements, characterised in that said fastener comprises holding means for

holding said tapes together at a predetermined position intermediate first and second areas of said coupling elements, the holding means being releasable when a predetermined force is applied to the holding means, to allow the coupling elements within the first and second areas to disengage.

The fastener according to the present invention may be used to close an airbag opening, such as an airbag opening in the seat of a car or other motor vehicle

A force for releasing the holding means will come from the pressure of the airbag against the fastener. However, although this pressure will primarily be in a direction perpendicular to the plane of the fastener, for example the side of the seat, the fastener is also stretched within the plane of the stringer tapes. The force (or displacement) from the airbag, perpendicular to the side of the seat and/or the stretching force, may be utilised to open the fastener.

As mentioned above, coupling elements are more easily separated by peeling apart from open region of the fastener than within a connected region of the fastener. The tapes may be joined at ends of the first and second areas furthest from the opening point, to prevent the fastener from opening at those ends.

The holding means for holding the tapes together may take a variety of forms.

One form comprises a pair of sliders which are mounted onto the first and second areas of coupling elements respectively, to open the coupling elements when the sliders are moved away from one another, and to close the coupling elements when moved towards one another. As well known in the art, the coupling elements at the leading end of a slider are separated within the slider body. Hence, with appropriate slider geometry, the sliders can be urged back along the tapes, opening the fastener, by a force which causes the tape to bulge in the region of the sliders. Preferably a stop is provided to position the sliders when the fastener is closed, the sliders providing a point of weakness where the force of the airbag will cause the fastener to start to open.

The two sliders may be provided without a puller, or with a removable puller for removal after the fastener has been installed and fastened, so that the slider are less likely to be accidentally moved or interfered with while the fastener is installed on a car seat.

A link may be provided for linking two sliders together, the link being broken or separated by the force of the exploding air bag, for example. The link may be cooperating locking parts provided on the slider bodies or provided on the slider pull tabs, for example.

The link may directly connect the first slider to the second slider, co-operating formations on the two sliders holding them together. Thus, the link is separated or broken in order to allow the sliders to move apart to open the fastener.

An intermediate linking element may be provided, the linking element being connected to the two sliders.

The force required to separate the two sliders will be dependent on factors such as the chosen size and type of linking means, and the ease of moving the slider along the coupling elements on the stringer tape, etc.

In another embodiment, the holding means may comprise a link which joins the stringer tapes when the fastener is closed. The link may be a frangible element, needing replacement after it has been broken a single time. Alternatively, the link may be reconnectable, such that if the link is opened, it fastener may subsequently be closed again by closing the coupling elements in the first and second areas and re-closing the link. The link may be made of a plastics material.

A frangible link may be formed by welding, fusing or melting an area of the stringer tapes to join the two stringer tapes, or by attaching a piece of material across the two stringer tapes to bridge them. The force required to break the link may be determined

by the material, by the welding or joining process used, by an area over which the join or weld extends, and/or by providing a weakened region, etc.

A replaceable disposable link which is breakable when a large enough force is applied to it, such as a clasp, clip, or breakable moulded element, may be provided. The disposable link may be directly connected to both the stringer tapes. In another embodiment it may be connected to the stringer tape via a piece of tape. This tape may be welded, glued or otherwise fixed onto the stringer tape. The disposable link may comprise a single breakable part, and a line of weakness may be provided on the breakable part, such as a thin area, along which the link will break under tension.

The disposable link may comprise two parts which are connected together, but which separate when a sufficient force is applied.

The airbag expansion force, i.e. the force at which the fastener should open, is expected to be around 400 Newtons, although this may vary with the model of car used and the size of airbag used. The holding means must be chosen such that the fastener will open under the pressure of the exploding air bag, but will not during normal use of the vehicle.

Preferably the length of the fastener is around 50cm.

The coupling elements may extend in continuous rows along the respective tapes. The first and second areas may both be part of the continuous rows of coupling elements. In another embodiment, gaps are formed along the rows of coupling elements to provide the first and second areas. The gap may be located in the centre of the fastener, or in an off-centre position. The holding means may be provided in the gap.

The fastener may be arranged to open at more than one point along its length. A plurality of gaps may be provided, dividing the rows into more than two areas. A link may be provided in each gap.

The coupling elements may be helically wound coil elements or may be discrete interlocking teeth elements of metal or moulded plastics as well known in the art.

The fastener may be reusable or may be designed for a single use.

The coupling elements are mounted on a longitudinal marginal edge of the stringer tape. Where a slider is provided, it may be moved along the stringer tapes to bring the fastener element rows into or out of engagement with each other.

After the fastener has opened, and the airbag has inflated, the airbag may subsequently be removed or deflated. A replacement airbag may be put inside the opening in the car seat, and the fastener may be closed, to make it ready for use again. If the fastener comprises a slider, the slider may be used to close the coupling elements. However, if the fastener does not comprise a slider, a special tool may be used to close the coupling elements. A known example of such a tool is a jig with a part for pressing the coupling elements together, and a handle for moving the jig along the row of coupling elements.

DESCRIPTION OF THE DRAWINGS:

Preferred embodiments of the present invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Figure 1A shows a top view of a first embodiment of the invention, and figure 1B shows a perspective view of the link of the first embodiment;

Figure 2 shows a perspective view of a car seat with the fastener of the first embodiment on the side of the seat;

Figure 3 shows a top view of a second embodiment of the invention in which a tape or a weld link is provided to link the stringer tapes together;

Figure 4A shows a top view of a third embodiment of the invention, in which the link is provided by a clip. Figure 4B shows a top view of the clip when open, and figure 4C shows a cross sectional view of the clip;

Figures 5A-C show a perspective view and two cross sectional views of a fourth embodiment in which the link is provided by a two part link with a pushing pin to allow separation when a force is applied to the pin;

Figure 6 shows a fifth embodiment of the invention in which a pair of sliders is provided;

Figure 7 shows a top view of a sixth embodiment of the invention in which a pair of linkable sliders are provided;

Figure 8 shows a top view of a seventh embodiment of the invention in which a pair of sliders with a separate linking element is provided to connect the sliders; and

Figures 9A-D show perspective views of a pair of sliders and pulltabs according to an eighth embodiment of the invention.

Figure 10 shows a side view of a jig for closing the coupling elements on a fastener without a pair of sliders.

DETAILED DESCRIPTION OF THE INVENTION:

The following provides a list of the reference characters used in the drawings:

20	Car seat
21	Back cover
22	Side
23	Opening
30	Airbag

100 Fastener

101 Inner longitudinal marginal edge

102 Stringer tape

104 Coupling element

106 First area

107 Second area

109 End

110 Gap

115 Link

120 Stop

125 Slider

128 Linking means

130 Front end

131 Back end

140 Clip

141 First part, male part

142 Second part, female part

143 Arrow-headed engaging head

144 Core portion

145 Leg portion

146 Cavity portion

147 Front wall

148 Rectangular engaging hole

149 Leg portion

150 Projection

152 One part

154 Thin neck portion

160 Linking part

162 Complementary-shaped blind recess

170 Pulltab

171 Pulltab

172 Male connector element

173	Female connector element
180	Common link element

Figure 1A shows a first embodiment of the invention, with the fastener closed, and figure 2 shows the fastener 100 of the first embodiment in position on a car seat 20.

The fastener 100 comprises two stringer tapes 102, with a plurality of coupling elements 104 mounted on the inner longitudinal marginal edges 101 of the stringer tapes 102. The coupling elements 104 interlock to close the fastener and connect the stringer tapes 102 together, as well known in the art. With the fastener closed, the coupling elements 104 are engaged in a first area 106 and a second area 107. The region between the first and second areas does not have coupling elements 104 attached, but instead, a gap 110 is provided between the first and second areas. The gap 110 is located in the centre of the fastener. A link 115 is provided in the centre of the gap, joining the two stringer tapes 102 together at this point to prevent the coupling elements peeling apart. The ends 109 of the fastener 100 are fixed together by a link (not shown) or by sewing to the seat cover

Figure 1B shows a perspective view of the link 115. The link 115 may be formed of plastics by insert moulding on to the opposed edges 101 of the tapes 102, a waisted region being formed, at which the link will break when subjected to a predetermined force. In another embodiment, halves of the link may be formed on respective tape edges, and then joined at the waisted region by ultrasonic welding, for example.

As shown in figure 2, the car seat 20 has a frame shaped like the seat and a back cover 21 covering the frame inside which back cover an airbag 30 has been installed. The side 22 of the back cover 21 of the car seat 20 has an opening 23 running vertically along it, the opening being about 500mm in length. A fastener 100 according to the first embodiment of the invention is sewn into the opening in the car seat cover. When a collision occurs, the airbag 30 will explode or expand rapidly and push against the fastener 100. The gap 110 and the link 115 are positioned at a location which will be impacted by the exploding air bag. As the airbag 30 expands, the link 115 will break

and the coupling elements 104 in the first and second areas will subsequently peel apart, thus opening the entire fastener to allow the air bag to expand through the opening 23.

Figure 3 shows a second embodiment of the invention, again showing the fastener while it is closed. A pair of stringer tapes 102 are provided with a plurality of coupling elements 104 attached to their edge, to allow the stringer tapes 102 to be connected. A gap 110 is provided between a first and second areas 106, 107 of the coupling elements. A link 115 is provided. In this embodiment, the link comprises a weld or a tape link. The weld link may be formed by partially melting adjacent areas of the two stringer tapes, for example with ultrasonic welding, in order to join the stringer tapes. This is particularly suitable for helical filament type fastener elements where the heads of the coupling elements are quite short and so the tape edges tend to be quite close together. A tape link may be formed by attaching a piece of tape, such as taffeta tape, by gluing, sewing or welding to both stringer tapes to bridge the gap between the stringer tapes. When force is applied by an airbag, the weld or tape link will break, and the fastener will then open.

Figure 4A shows a third embodiment of the invention in which the link 115 comprises a clip 140. The clip 140 comprises a first, male part 141 and a second, female part 142 which are connected to the first and second stringer tapes respectively. The first 141 and second 142 parts of the clip 140 engage together to close the clip 140 and join the stringer tapes. Male part 141 has an arrow shaped engaging head 143 which is received in the female part 142 to hold the two parts 141, 142 together. Such clip designs are well known. The clip 140 may be welded directly to the tape, or may be welded to another piece of tape which is attached to the stringer tapes. The clip 140 may be reusable, opening under a predetermined force but being reconnectable.

Figures 4B and 4C show more detailed views of the structure of the clip 140 of figure 4A. Figure 4B is a top view, showing three open clips 140 attached to stringer tapes, and figure 4C is a cross sectional view of one of the clips 140, taken along line A-A of figure 4B. A core portion 144 is formed on the edge of each stringer tape 102. Both the female 142 and male 141 parts of the clip 140 have a leg portion 145, 149 for

sandwiching the core portions 144 from above and below to hold the clip parts 141, 142 onto the stringer tapes 102. The female part 142 of the clip has a cavity portion 146 which is long in a longitudinal direction of the stringer tape 102 and which vertically penetrates a front face of the leg portion 145. A front wall 147 at the end of the cavity portion 146 is defined with a rectangular engaging hole 148 which is long in the longitudinal direction of the tape such that the engaging hole 148 communicates with the cavity portion 146 and the engaging head 143 of the male part 141 can be inserted into and engaged with the engaging hole 148.

The male part 141 has a thin neck portion 154 projecting from a front face of the leg portion 149 and having a width smaller than that of the leg portion 149 and substantially equal to that of the engaging hole 146. The engaging head 143 is mounted to an end of the neck portion 154, and is arc-shaped, having the same width as that of the neck portion 154 and being triangular in cross section such that the engaging head 143 can receive the front wall 147 of the female part 142.

Figures 5A-C show a fourth embodiment of the invention, comprising a fastener 100 which opens due to direct displacement of a part of a link by the airbag. The fastener comprises a two-part link element 115 which opens in a direction perpendicular to the stringer tapes. A projection 150 is provided on one part 152 of the link element 115 and faces the air bag. The projection 150 is positioned over the airbag, in a position in which the airbag will give the greatest displacement. In this embodiment, the projection 150 is a blunt ended pin.

Figure 5A shows a perspective view of the link element with the projection. Figure 5B shows a cross-sectional view of the link element when it is in a closed position, and Figure 5C shows a cross-sectional view of the link element when it is in an open position.

The link element 115 comprises first 152 and second 151 parts, with the projection 150 provided on the first part 152, and a linking part also being provided on the first part 152. The linking part 160 is in the from of a tongue which is received in a

complementary shaped blind recess 162 in the second part 151 of the link element, preventing separation of the parts 151, 152 in the plane of the tapes 102. . The linking part 160 is displaced from the recess 162 when pressure is applied to the pin 150 by the exploding air bag, in a direction perpendicular to the stringer tapes 102.

Figure 6 shows a fifth embodiment of the invention in which the fastener is again shown in a closed state. As in the previous embodiments, a pair of stringer tapes 102 are provided, each stringer tape having a first area 106 and a second area 107 with coupling elements mounted along an inner edge 101 of the stringer tape 102. A stop 120 is provided in a gap 110 in the rows of fastener elements, to prevent movement of a slider 125, 126 too far along the tapes, thus ensuring that the sliders meet at the required position for engagement by the exploding air bag. Such stops are well known in the art and may be provided for example by attaching clips to the tapes.

Instead of a link 115 etc. being provided to connect the stringer tapes in the gap 110, the fastener is held closed by the pair of sliders 125, 126 mounted on the fastener chain 105. Each slider has a front end 130 and a back end 131. As well known in the art, forward movement of the slider along the stringer tapes closes the fastener, and movement backwards opens the fastener.

When the air bag expands, the pressure of the bag will cause the fastener 100 to bulge outwards, tending to separate the tapes 102 at the gap 110 and causing the sliders to move back along the tapes, opening the fastener.

Figure 7 shows a sixth embodiment of the invention. This is similar to the fifth embodiment, except that in this case the two sliders 125, 126 are connected to each another. In this embodiment each slider comprises a female element and a male element. The female element of one slider is connectable with the male element of the other slider, and vice versa, to allow the two sliders to connect together. When a force is applied from the exploding airbag, the two sliders are pushed apart, thus disengaging the link between them. The strength of the link between the sliders can be controlled, thus providing more control over the force required to open the fastener.

Figure 8 shows a seventh embodiment of the invention. This is similar to the sixth embodiment, except that instead of the two sliders 125, 126 linking directly to one another, each of the sliders links to a common link element 180. The length of the link element 180 may be varied to modify the minimum force required to open the link. The type of connection used between the link element and the first and second sliders will also influence the strength of the link.

Figures 9A-D show perspective views of a pair of sliders and pulltabs according to an eighth embodiment of the invention. The eighth embodiment is similar to the sixth embodiment, except that each slider 125, 126 is provided with a pulltab 170, 171, and the two pulltabs 170, 171 are provided with means to connect to each other. Figure 9A shows a pair of sliders 125, 126 and pulltabs 170, 171 when connected together, and figure 9B shows a pair of sliders 125, 126 and pulltabs 170, 171 when disconnected. Figure 9C shows an enlarged view of the two pulltabs 170, 171 when connected together, and figure 9D shows an enlarged view of the two pulltabs 170, 171 when disconnected.

One pulltab 170 is provided with a male connector element 172, and the other pulltab 171 is provided with a female connector element 173. The male connector element 172 is a snap-fit in the recess provided by the female connector element 173. When the airbag expands, the force of the airbag disengages the two connector elements 172, 173, and allows the fastener to open. The coupling parts 172 and 173 may deform on being separated, in which case the pull tabs could be removed and fresh pull tabs attached to the sliders for re-use of the fastener.

The weak point of the zip fastener is formed by the connection of the pull tabs which provide for opening and closing easily as well as providing a controlled breaking or bursting point of the fastener. It is also possible to use a combination pull tab wherein each of the two sliders has the same design. For example, each slider may be provided with both a male connector element and a female connector element. The pulltabs shown in figures 9A-D are solid parts, but alternatively, they could be fabric pulltabs.

Fabric pull tabs may be connected with a snap fastening button such as a press stud or a 'linesnap' fastener as marketed by YKK, instead of the connector elements shown in figures 9A-D.

In a further embodiment, instead of being linked by a re-usable link, the two sliders are linked by a solid clip which breaks off with the force of the airbag. This embodiment provides a one-time use. The clip is free to fly off in any direction, however, if preferred, one side of the clip may be permanently fixed to one of the sliders, to prevent the clip from flying off completely.

Figure 10 shows a jig which may be used to re-close the coupling elements on the stringer tapes after the fastener has been opened, in the absence of a slider. The jig may be closed around teeth of the fastener element and slid along the length of the stringer tape, closing the coupling elements as it is moved. Such jigs are well known in the art of zip fastener manufacture. To be specific, as shown in Figure 10, the jig is comprised of a curved frame member 200, and a pair of upper and lower wings 202 and 204 mounted on the upper and lower ends, respectively, of the frame member 200. The upper wing 202 has a guide post 206 mounted on its lower side. The upper wing 202 and the lower wing 204 are movable toward and away from each other. When the guide post 206 of the upper wing 202 comes into contact with part of the lower wing 204, the upper wing 202 and the lower wing 204 define therebetween a Y-shaped channel through which rows of coupling elements 104 pass. As the jig is slid longitudinally of the stringer tapes with the coupling element rows passing through the Y-shaped channel, the jig closes the coupling elements, as a slider does.

A further use of the present invention is to form a closure for doors, such as shutter doors. For example, in a warehouse or factory, shutter doors such as PVC doors may be provided to divide separate areas or to protect an opening for goods or vehicles from the outside weather or elements. When a reusable fastener according to the invention is provided for closure of an edge of such a shutter door, a vehicle driving accidentally into the door will open it, avoiding damage to the door. Afterwards, the fastener may be re-closed.

A fastener may be provided with sliders for this purpose to make it easier to re-close. A fastener may comprise a single gap for opening or may comprise a plurality of gaps along the length of each stringer tape.

Conclusions, ramifications, and Scope of the Invention:

Thus the reader will see that the fastener of the invention provides a closure for an airbag opening which overcomes some of the problems mentioned above, and, in particular, provides a highly reliable closure for an airbag opening which closure comprises a zip fastener and means for facilitating opening of the fastener when a force is applied transverse to the plane of the fastener.

While the above description contains many specificities, these should not be construed as limitations on the scope of the invention, but rather as an exemplification of one preferred embodiment thereof. Many other variations are possible. Accordingly, the scope of the invention should be determined not by the embodiments illustrated, but by the appended claims and their legal equivalents.